WHAT IS CLAIMED IS:

1. A computer-implemented method for segmenting an orthodontic treatment path into clinically appropriate substeps for repositioning the teeth of a patient, comprising:

providing a digital model of the shape and material of each of a sequence of appliances to be applied to a scanned model of the teeth;

computing the actual effect of the appliances on the teeth by performing finite element analysis on each of said models;

evaluating the effect against clinical constraints; and

generating data sets corresponding to a plurality of appliances having geometries selected to progressively reposition the teeth, wherein the appliances comprise polymeric shells having cavities and wherein the cavities of successive shells have different geometries shaped to receive and resiliently reposition teeth from one arrangement to a successive arrangement.

2. A method as in claim 1, further comprising fabricating individual polymeric shell appliances based on individual ones of the data sets.

3. The method of claim 2, wherein the appliances are manufactured by fitting polymeric sheets over positive models corresponding to the data sets.

4. The method of claim 1, wherein the sequence of appliances includes a sequence of polymeric shells manufactured by stereo lithography from digital models.

5. The method of claim 1, further comprising:

comparing the actual effect of the appliances with an intended effect of the appliances;

identifying an appliance as an unsatisfactory appliance if the actual effect of the appliance is more than a threshold different from the intended effect of the appliance; and

modifying a model of the unsatisfactory appliance according to the results of the comparison.

6. The method of claim 5, wherein the model of the unsatisfactory appliance is modified by modifying the shape of the unsatisfactory appliance.

7. The method of claim 6, wherein the shape of the unsatisfactory appliance is modified by adding a dimple.

8. The method of claim 6, wherein the shape of the unsatisfactory appliance is modified by adding material to cause an overcorrection of tooth position.

9. The method of claim 6, wherein the shape of the unsatisfactory appliance is modified by adding a ridge of material to increase stiffness.

10. The method of claim 6, wherein the shape of the unsatisfactory appliance is modified by adding a rim of material along a gumline to increase stiffness.

11. The method of claim 6, wherein the shape of the unsatisfactory appliance is modified by removing material to reduce stiffness.

12. The method of claim 5, wherein the unsatisfactory appliance is redefined to have a shape defined by the complement of the difference between the intended effect and the actual effect of the unsatisfactory appliance.

13. The method of claim 1, wherein the clinical constraints include a maximum rate of displacement of a tooth, a maximum force on a tooth, and a desired end position of a tooth.

14. The method of claim 13, wherein the maximum force is a linear force or a torsional force.

15. The method of claim 13, wherein the maximum rate of displacement is a linear or a angular rate of displacement.